Therefore, the heat is generated at a point deeper than the N^{++} region **207***a*, and the ESD capability can be thereby improved.

[0011] In the constitution according to the second conventional technology described above, the retained voltage Vh is determined by the product of the current flow in operating the transistor and the resistance between the collector and emitter. Therefore, separation of the high-density N-type sink layer **203** and the P^+ layer **205** are further increased in the constitution according to the second conventional technology in order to form the resistor in the N^- layer **202***a*. As a result, the transistor OFF withstand voltage BV_{cbo} and the retained voltage Vh can be increased as shown in FIG. **8**.

[0012] However, the increase of the retained voltage Vh is still insufficient, and the protection device can be used only in a limited voltage range. Further, the amount of heat generated in joint part of the collector-base is increased, which lowers the secondary breakdown current It**2**. FIG. **8** shows variations of the transistor OFF withstand voltage BV_{cbo}, retained voltage Vh and secondary breakdown current It**2** to the separation between the high-density N-type sink layer **203** and the P^+ layer **205**.

[0013] Thus, in the constitution according to the second conventional technology proposed in order to obtain the sufficient retained voltage Vh, it is necessary to provide another constitution for improving the retained voltage Vh because the merit of the second conventional technology is lost.

[0014] In the second conventional technology, the resistance formed in the horizontal direction by the high-density N-type sink layer **203** is defined by a degree of diffusion of the high-density N-type sink layer **203** extended in the horizontal direction because the high-density N-type sink layer **203** is formed in the same section as that of the N^{++} region **207***a*, however, the value of the resistance thus defined is not sufficient. Therefore, the retained voltage of the ESD protection device of the NPN-transistor type may be lower than the maximum operation voltage in the integrated circuit having a high voltage resistance, which unfavorably results in the secondary breakdown of the protection device itself.

SUMMARY OF THE INVENTION

[0015] Therefore, a main object of the present invention is to provide an ESD protection device that can be prevented from secondary breakdown in such a manner that a retained voltage Vh is made to a higher voltage without depending on a value of a maximum operation voltage of an internal circuit.

[0016] In order to achieve the foregoing object, an electrostatic discharge protection device according to the present invention is an electrostatic discharge protection device of a semiconductor integrated circuit consisting of a bipolar transistor, comprising:

[0017] a semiconductor substrate of a first conductivity type;

[0018] a first diffusion layer that is a diffusion layer of a second conductivity type provided on the semiconductor substrate and serves as a collector;

[0019] a second diffusion layer that is a diffusion layer of the first conductivity type provided in the first diffusion layer and serves as a base;

[0020] a third diffusion layer that is a diffusion layer of the second conductivity type provided in the second diffusion layer and serves as an emitter;

[0021] a collector contact region provided in the first diffusion layer;

[0022] a fourth diffusion layer that is a diffusion layer of the second conductivity type provided in the first diffusion layer in a downward region in a substrate-thickness direction of the collector contact region, and is formed shallower than that of the first diffusion layer in the substrate-thickness direction, deeper than that of the second diffusion layer in the substrate-thickness direction and with a higher density than that of the first diffusion layer; and

[0023] an insulation film formed on a surface of the first diffusion layer between the second diffusion layer and the collector contact region so as to serve as a field, wherein

[0024] the fourth diffusion layer is extended through a region below the insulation film.

[0025] The first conductivity type and the second conductivity type respectively refer to one of p type and n type of the semiconductor. When the first conductivity type is the p type, the second conductivity type is the n type. Adversely, when the first conductivity type is the n type, the second conductivity type is the p type.

[0026] According to the foregoing constitution, by extending the fourth diffusion layer from the collector contact region through the region below the insulation film, a built-in resistor is formed in the fourth diffusion layer so as to generate voltage drop. As a result, the retained voltage Vh is made to a higher voltage in comparison to the case where the fourth diffusion layer is not provided below the insulation film.

[0027] In the foregoing constitution, it is preferable that the collector contact region and the emitter are connected to an output terminal of the semiconductor integrated circuit, and the collector contact region is connected to an output terminal having a potential higher than that of the output terminal connected to the emitter. Further, it is more preferable that the collector contact region is connected to a highest-potential terminal of the semiconductor integrated circuit, and the emitter is connected to a lowest-potential terminal of the semiconductor integrated circuit.

[0028] In the foregoing constitution, an extended dimension of the fourth diffusion layer extending from a border between the collector contact layer and the insulation film to below the insulation film is preferable to be at least 10 μm. The region of the fourth diffusion layer below the insulation film forms the built-in resistor, and the built-in resistor is serially connected to the collector. The built-in resistor conforms to the extended width of the fourth diffusion layer region below the insulation film, and the tilt of the snap-back characteristic is increased as the extended width is increased. According to an experiment, the extended width is desirably at least 10 μm in order to maintain the retained voltage Vh to be at least 40 V.

[0029] In the foregoing constitution, it is preferable that a fifth diffusion layer of the first conductivity type is formed in at least a part of the fourth diffusion layer below the insulation film. By doing this, a pinch resistor is formed in the region of the fourth diffusion layer below the fifth diffusion layer, and the pinch resistor is serially connected to the collector of the transistor. Even when it is desirable to obtain the higher retained voltage Vh, therefore, the retained voltage Vh can be further increased by changing the width